IR Imaging Spectroscopy of SL9 Sites: Spatial and Vertical Distributions of NH_3, C_2H_4, and Dust Emission

T. Greathouse, C. A. Griffith (NAU), Bruno Bezard (Obs. Paris-Meudon), D. Kelly, J. Lacy (U. of T.)

Spatially resolved spectroscopy of SL9 sites traces the dynamical evolutions of cometary material, upwelled tropospheric gas and compounds produced when the plume splashed back upon the atmosphere. The emissions of impact-produced stratospheric NH_3, C_2H_4 and dust were imaged at NASA's IRTF with Irshell 21 hours, 6, 11 and 12 days following the K impact. Ammonia lines at 908 and 948 cm^{-1} and C_2H_4 lines at 948.8 cm^{-1} were analyzed for each 0.8x1" pixel over a $\sim$7x17" region centered at the K site; the spectral resolution was $\sim$15,000. We find evidence for two sources of NH_3. Most of the stratospheric NH_3 was found in a confined region around 20 mbar. A second reservoir existed above 1 mbar, with a column abundance $\sim\frac{1}{25}$ lower than that of the deeper source (1-3$\times10^{17}$ molecules cm^{-2} above 40 mbar for the K site). The position of the high altitude NH_3 indicates that it rose and was quenched within the fireball and survived the splash. The 3-6$\times10^{13}$ g of low altitude NH_3 indicates that the K impact upwelled at least $\sim2\times10^{16}$ g of jovian gas from Jupiter's troposphere. The NH_3 line shape 12 days following impact indicates a depletion rate of the high altitude source, suggesting NH_3 was partially shielded from UV radiation. Enhanced continuum emission is consistent with $1\pm0.2\times10^{13}$ g of cometary dust, equivalent to a $\sim$0.3 km comet, assuming 8% olivine composition. The total mass of C_2H_4 was found to be $1\pm0.3\times10^{12}$g and remained constant within error throughout the observations. Ammonia at 20 mbar spread out with time, however its coverage was never as extensive as that of the dark material seen in HST images. In contrast, the dust, C_2H_4 and HCN (Bézard *et al.* 1996), observed at significantly lower pressures than NH_3, covered a broader spatial extent, similar to the coverage of the ejecta blanket observed by HST. Six days following impact, the dust and C_2H_4 spread 7° eastward of NH_3, similar to the dark material observed by HST. The quiescent behavior of the NH_3 at 20 mbar in contrast to the zonal drift of the dust indicates the presence of winds above 1 mbar that are disconnected from those in the lower stratosphere.

Abstract submitted for 1996 DPS meeting

Date submitted: LPI electronic form version 5/96

Division for Planetary Sciences Abstract Form

DPS Category 12 Running #7497 Session 0.00

Invited ☐ Poster presentation ☒ Title only ☐

Have you received your Ph.D. since the last DPS meeting?

Yes ☐ No ☒

Is your abstract newsworthy, and if so, would you be willing to prepare a news release and be available for interviews with reporters?

Yes ☐ No ☒ Maybe ☐

Paper presented by Thomas Greathouse
Department of Physics and Astronomy
Northern Arizona University

Flagstaff AZ 86011 USA
Phone: 520-523-5452
Fax: 520-523-1371
Email: tommyg@vela.phy.nau.edu

Special instructions: Tue Aug 27 17:12:58 CDT 1996

Membership Status (First Author):

DPS-AAS Member ☐ Non-Member ☐

Student Member ☐ Student Non-Member ☒

Is this your first DPS presentation? Yes ☒ No ☐

Sponsor: Caitlin A. Griffith